Stroke and Traumatic Brain Injury (Ma'i Ulu) in Amerika Samoa

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This paper discusses the annual incidence of stroke and traumatic brain injury (TBI) in American Samoa. Findings are based on data collected from the medical records at LBJ Tropical Medical Center in Amerika Samoa from June 1, 1989 to May 31, 1990. A review of these medical records revealed that stroke and TBI were prevalent among the residents of Amerika Samoa during the time period sampled. Health and cultural factors which contribute to the occurrence of stroke and TBI in Amerika Samoa and recommendations for further investigation and prevention of stroke and TBI in that country are discussed.

Neurological impairment may affect individuals from any racial or cultural group. However, the prevalence of specific causes of neurological impairment may vary across groups as a result of differences in genetic makeup, immunity factors, diet, living environment and cultural practices[1]. These issues have been highlighted as they pertain to the multicultural population within the continental United States[2,3]. However, there is a paucity of information addressing neurological impairment among American citizens from the multicultural community who reside in rural areas outside of the continental United States. One such group is the Amerika Samoans.

Amerika Samoa is a territory of the United States located in the Pacific Ocean approximately 2,000 miles southwest of Hawaii. The estimated population is 45,500[4]. Since World War II, the territory of Amerika Samoa has been greatly affected by Americanization, which some speculate could be a major contributor to increases in specific causes of neurological impairment among this population. These include stroke, which might be related to changes in diet, an increase in the prevalence of hypertension and diabetes[5,6]; and traumatic brain injury (TBI) or *ma'i ulu* as it is called in that country[7], related to increases in violent assaults[8] which typically involve a blow to the head with a club or rock, and motor vehicle accidents[9].

This study was conducted to obtain information about the occurrence of stroke and TBI among individuals seen at the LBJ Tropical Medical Center (LBJ) in Amerika Samoa over a one year period, from June 1, 1989 to May 31, 1990.

Methods

Data were compiled from the medical files at LBJ, which is the only major medical center serving the residents of the Amerika Samoan Islands. LBJ has recently installed a computer-based system for entry of patient information for all registrants at the hospital. However, because complete data entries for the research period were not available at the time of data collection, it was not possible to obtain reliable information from a computer search. For this reason data for this study were compiled directly from the patient registration log books and the patient medical files for all inpatients seen at LBJ during the research period. Outpatient information was excluded from the review because the LBJ medical staff indicated that at their medical facility all individuals with a suspected diagnosis of stroke and TBI were admitted as inpatients. It was judged, therefore, that a review of inpatient log books would provide an accurate and direct means of identifying cases.

Inpatient Log Review

Patient medical chart numbers and corresponding medical intake diagnoses of stroke, TBI, or related diagnoses were compiled from the log books of 4 major hospital wards at LBJ: The intensive care, surgical, medical, and pediatrics units. Related diagnoses were included at this point in the search, in an effort to obtain a complete-as-possible list of likely stroke and TBI patients.

For the stroke group this included individuals with an initial intake diagnosis of stroke, cerebral vascular accident, hypertension, infarct, hemorrhage, TIA, dysphagia, ischemia, possible aspiration pneumonia, and questionable neurological status.

For the TBI group this included individuals with an initial intake diagnosis of traumatic brain injury, head injury, subdural hematoma, skull fracture, motor vehicle accident, cerebral concussion, scalp laceration, compound fracture, accidental fall, and scalp abrasion.

After the initial intake list was compiled, the same inpatient intake log books were independently reviewed by a research assistant to ensure that no possible stroke or TBI cases had been omitted. A total of 162 patients: 74 possible stroke cases and 92 possible TBI cases were identified in this manner from the log review.

Medical Chart Review

The medical charts contained information about the final definitive diagnosis as determined by each patient's physician. Charts for all 166 patients were reviewed to confirm the diagnosis of stroke or TBI. Patients with medical chart diagnoses other than stroke or TBI were eliminated from the roster at this point. The chart review was conducted by 2 teams comprised of the investigator and 3 research assistants. Each chart was reviewed by both members of a team as a self-check to minimize inaccuracies in data recording. For confirmed cases of stroke or TBI, information pertaining to birthdate, gender, ethnicity, cause (for TBI cases), presence of hemiplegia and survival post insult (for stroke cases) also was recorded.

Results

Stroke

Seventy-four individuals were seen at LBJ with a stroke-

(Continued on page 236) ➤

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(Continued from page 234)

related diagnosis from June 1, 1989 to May 31, 1990. This included 29 adults who were admitted with a stroke diagnosis and who survived to the point of discharge (mean age 65 years, sd=8.15). Forty-five adults (mean age 68, sd=13.35) were recorded as having stroke-related fatalities. The mean age in years for the fatalities was slightly greater than for the surviving cases.

Individuals from a variety of ethnic backgrounds are treated at LBJ (including Korean, Tongan, European, Japanese, Chinese, Filipino, Micronesian, and Fijian). However, during the period of data collection for this study, only individuals of Samoan ancestry were identified as having incurred new episodes of stroke during the period of data collection for this study. Summary information for new stroke cases is presented in Table 1.

Of the stroke survivors, there were 23 males and 6 females. Eighty-six percent (n=25) of these survivors demonstrated observable motor impairment. This was true of 24 patients who were hemiplegic and 1 patient who had ataxic motor involvement, according to the medical records.

Stroke-related fatalities comprised approximately 24% (n=45) of the total deaths recorded at LBJ for that same time period (N=186). Stroke-related fatalities included 11 individuals who died of stroke-related problems after hospitalization and 34 who were dead on arrival at the hospital. According to the LBJ medical staff, diagnostic labels of stroke, CVA, history of hypertension, intracranial bleeding, cerebral hemorrhage, subarachnoid hemorrhage, arteriosclerotic vascular disease, and diabetes-related deaths are used in their medical center to indicate a stroke-related diagnosis. Patients with any of these diagnoses listed as a primary cause of death on the death certificate were considered to have died from stroke-related causes. The range in diagnostic labels used to indicate stroke, may be due to the fact that there is no neurologist on staff to assist with a final diagnosis.

TABLE 1

New Stroke Cases Seen at LBJ Tropical Medical Center From June 1, 1989, May 31, 1990

	CVA Fatalities		CVA Survivors	
	No.	Mean Age in years	No.	Mean Age in years
Male	23	64 sd=14.89	23	65 sd=8.31
Female	22	72 sd=10.43	6	69 sd=7.34
Total Male & Female	45	67.53 sd=13.35	29	65 sd=8.15

TABLE 2

New Surviving Adult Cases of Traumatic Brain Injury (TBI) Seen at LBJ Tropical Medical Center From June 1, 1989 to May 31, 1990

	CAUSES				
	Violent Assaults	Motor Vehicle Accidents	Accidental Falls	Misc. Accidents	All Causes
Male	24	11	6	—	41
Female	—	2	1	1	4
All Cases	24	13	7	1	45
Mean Age in Years for all Cases	30 sd=8.77	25 sd=5.54	42 sd=16.11	54 sd=0.00	31 sd=11.22

TABLE 3

New Surviving Cases of Pediatric Traumatic Brain Injury (TBI) Cases Seen At LBJ Tropical Medical Center From June 1, 1989 to May 31, 1990

	CAUSES					
	Violent Assaults	Motor Vehicle Accidents	Accidental Falls	Sports Related Accidents	Misc. Accidents	All Causes
Male	3	4	4	1	1	13
Female	—	5	6	—	—	11
All Cases	3	9	10	1	1	24
Mean Age in Years for all Cases	17 sd=.58	6 sd=3.77	6 sd=5.99	15 sd=0.00	6 sd=0.00	8 sd=5.91

Traumatic Brain Injury

According to information provided in the log book, 92 individuals were suspected of having incurred TBI from June 1, 1989 to May 31, 1990. Review of medical charts confirmed that 76 of the original 92 were actual TBI cases. Sixty-nine of these were TBI survivals and 7 were TBI fatalities (6 adults and 1 child). Forty-five of the surviving individuals were adults ranging in age from 19 to 70 (mean age=31 years, sd=11.22) and 24 were children ranging in age from 6 months to 18 years (mean age=8 years, sd=5.91). Two percent of the adult TBI survivors and less than 1% of the pediatric TBI survivors were of non-Samoan ancestry. Ethnic backgrounds for these non-Samoan cases were Korean (n=7), Chinese (n=1), Filipino (n=1), and Tongan (n=1). Summary information for adult and pediatric TBI survivors is presented in Table 2 and 3.

In the adult population, violent assaults and motor vehicle accidents were the most commonly listed causes of TBI, accounting for 82% of all cases. Accidental falls and miscellaneous accidents (hit by a ceiling fan) were reported to be causal factors in 18% of the adult TBI cases.

The most common causes of TBI in the pediatric population were accidental falls and motor vehicle accidents, which accounted for 79% of all reported cases. Violent assaults, sports-related accidents (rugby) and miscellaneous accidents (struck on the head with a hammer) were the cause of TBI in 21% of the pediatric TBI cases.

bone marrow assay.

Enalapril Maleate: There was no evidence of a tumorigenic effect when enalapril was administered for 106 weeks to rats at doses up to 90 mg/kg/day (150 times* the maximum daily human dose). Enalapril has also been administered for 94 weeks to male and female mice at doses up to 90 and 180 mg/kg/day, respectively, (150 and 300 times* the maximum daily dose for humans) and showed no evidence of carcinogenicity.

Neither enalapril maleate nor the active diacid was mutagenic in the Ames microbial mutagen test with or without metabolic activation. Enalapril was also negative in the following genotoxicity studies: rec-assay, reverse mutation assay with *E. coli*, sister chromatid exchange with cultured mammalian cells, and the micronucleus test with mice, as well as in an *in vivo* cytogenic study using mouse bone marrow.

There were no adverse effects on reproductive performance in male and female rats treated with 10 to 90 mg/kg/day of enalapril.

Hydrochlorothiazide: Two-year feeding studies in mice and rats conducted under the auspices of the National Toxicology Program (NTP) uncovered no evidence of a carcinogenic potential of hydrochlorothiazide in female mice (at doses of up to approximately 600 mg/kg/day) or in male and female rats (at doses of up to approximately 100 mg/kg/day). The NTP, however, found equivocal evidence for hepatocarcinogenicity in male mice.

Hydrochlorothiazide was not genotoxic *in vitro* in the Ames mutagenicity assay of *Salmonella typhimurium* strains TA 98, TA 100, TA 1535, TA 1537, and TA 1538 and in the Chinese Hamster Ovary (CHO) test for chromosomal aberrations, or *in vivo* in assays using mouse germinal cell chromosomes, Chinese hamster bone marrow chromosomes, and the *Drosophila* sex-linked recessive lethal trait gene. Positive test results were obtained only in the *in vitro* CHO Sister Chromatid Exchange (clastogenicity) and in the Mouse Lymphoma Cell (mutagenicity) assays, using concentrations of hydrochlorothiazide from 43 to 1300 µg/mL, and in the *Aspergillus nidulans* non-disjunction assay at an unspecified concentration.

Hydrochlorothiazide had no adverse effects on the fertility of mice and rats of either sex in studies wherein these species were exposed, via their diet, to doses of up to 100 and 4 mg/kg, respectively, prior to conception and throughout gestation.

Pregnancy: Pregnancy Categories C (first trimester) *and D* (second and third trimesters). See WARNINGS, *Pregnancy, Enalapril Maleate, Fetal/Neonatal Morbidity and Mortality.*

Nursing Mothers: Enalapril and enalaprilat are detected in human milk in trace amounts. Thiazides do appear in human milk. Because of the potential for serious reactions in nursing infants from either drug, a decision should be made whether to discontinue nursing or to discontinue VASERETIC, taking into account the importance of the drug to the mother.

Pediatric Use: Safety and effectiveness in children have not been established.

ADVERSE REACTIONS: VASERETIC has been evaluated for safety in more than 1500 patients, including over 300 patients treated for one year or more. In clinical trials with VASERETIC no adverse experiences peculiar to this combination drug have been observed. Adverse experiences that have occurred, have been limited to those that have been previously reported with enalapril or hydrochlorothiazide.

The most frequent clinical adverse experiences in controlled trials were: dizziness (8.6 percent), headache (5.5 percent), fatigue (3.9 percent) and cough (3.5 percent). Adverse experiences occurring in greater than two percent of patients treated with VASERETIC in controlled clinical trials were: muscle cramps (2.7 percent), nausea (2.5 percent), asthenia (2.4 percent), orthostatic effects (2.3 percent), impotence (2.2 percent), and diarrhea (2.1 percent).

Clinical adverse experiences occurring in 0.5 to 2.0 percent of patients in controlled trials included: *Body As A Whole:* Syncope, chest pain, abdominal pain; *Cardiovascular:* Orthostatic hypotension, palpitation, tachycardia; *Digestive:* Vomiting, dyspepsia, constipation, flatulence, dry mouth; *Nervous/Psychiatric:* Insomnia, nervousness, paresthesia, somnolence, vertigo; *Skin:* Pruritus, rash; *Other:* Dyspnea, gout, back pain, arthralgia, diaphoresis, decreased libido, tinnitus, urinary tract infection.

Angioedema: Angioedema has been reported in patients receiving VASERETIC (0.6 percent). Angioedema associated with laryngeal edema may be fatal. If angioedema of the face, extremities, lips, tongue, glottis and/or larynx occurs, treatment with VASERETIC should be discontinued and appropriate therapy instituted immediately. (See WARNINGS.)

Hypotension: In clinical trials, adverse effects relating to hypotension occurred as follows: hypotension (0.9 percent), orthostatic hypotension (1.5 percent), other orthostatic effects (2.3 percent). In addition syncope occurred in 1.3 percent of patients. (See WARNINGS.)

Cough: See PRECAUTIONS, *Cough.*

Clinical Laboratory Test Findings; Serum Electrolytes: See PRECAUTIONS.

Creatinine, Blood Urea Nitrogen: In controlled clinical trials minor increases in blood urea nitrogen and serum creatinine, reversible upon discontinuation of therapy, were observed in about 0.6 percent of patients with essential hypertension treated with VASERETIC. More marked increases have been reported in other enalapril experience. Increases are more likely to occur in patients with renal artery stenosis. (See PRECAUTIONS.)

Serum Uric Acid, Glucose, Magnesium, and Calcium: See PRECAUTIONS.

Hemoglobin and Hematocrit: Small decreases in hemoglobin and hematocrit (mean decreases of approximately 0.3 g percent and 1.0 vol percent, respectively) occur frequently in hypertensive patients treated with VASERETIC but are rarely of clinical importance unless another cause of anemia coexists. In clinical trials, less than 0.1 percent of patients discontinued therapy due to anemia.

Liver Function Tests: Rarely, elevations of liver enzymes and/or serum bilirubin have occurred.

Other adverse reactions that have been reported with the individual components are listed below and, within each category, are in order of decreasing severity.

Enalapril Maleate—Enalapril has been evaluated for safety in more than 10,000 patients. In clinical trials adverse reactions which occurred with enalapril were also seen with VASERETIC. However, since enalapril has been marketed, the following adverse reactions have been reported: *Body As A Whole:* Anaphylactoid reactions (see PRECAUTIONS, *Hemodialysis Patients*); *Cardiovascular:* Cardiac arrest; myocardial infarction or cerebrovascular accident, possibly secondary to excessive hypotension in high risk patients (see WARNINGS, *Hypotension*); pulmonary embolism and infarction; pulmonary edema; rhythm disturbances including atrial tachycardia and bradycardia; atrial fibrillation; hypotension; angina pectoris; *Digestive:* Ileus, pancreatitis, hepatic failure, hepatitis (hepatocellular [proven on rechallenge] or cholestatic jaundice), melena, anorexia, glossitis, stomatitis, dry mouth; *Hematologic:* Rare cases of neutropenia, thrombocytopenia and bone marrow depression, a few cases of hemolysis in patients with G-6-PD deficiency have been reported in which a causal relationship to enalapril cannot be excluded; *Nervous System/Psychiatric:* Depression, confusion, ataxia, peripheral neuropathy (e.g., paresthesia, dysesthesia); *Urogenital:* Renal failure, oliguria, renal dysfunction (see PRECAUTIONS), flank pain, gynecomastia; *Respiratory:* Pulmonary infiltrates, bronchospasm, pneumonia, bronchitis, rhinorrhea, sore throat and hoarseness, asthma, upper respiratory infection; *Skin:* Exfoliative dermatitis, toxic epidermal necrolysis, Stevens-Johnson syndrome, herpes zoster, erythema multiforme, urticaria, alopecia, flushing, photosensitivity; *Special Senses:* Blurred vision, taste alteration, anosmia, conjunctivitis, dry eyes, tearing.

Miscellaneous: A symptom complex has been reported which may include a positive ANA, an elevated erythrocyte sedimentation rate, arthralgia/arthritis, myalgia, fever, serositis, vasculitis, leukocytosis, eosinophilia, photosensitivity, rash and other dermatologic manifestations.

Fetal/Neonatal Morbidity and Mortality: See WARNINGS, *Pregnancy, Enalapril Maleate, Fetal/Neonatal Morbidity and Mortality.*

Hydrochlorothiazide—Body as a Whole: Weakness; *Digestive:* Pancreatitis, jaundice (intrahepatic cholestatic jaundice), sialadenitis, cramping, gastric irritation, anorexia; *Hematologic:* Aplastic anemia, agranulocytosis, leukopenia, hemolytic anemia, thrombocytopenia; *Hypersensitivity:* Purpura, photosensitivity, urticaria, necrotizing angiitis (vasculitis and cutaneous vasculitis), fever, respiratory distress including pneumonitis and pulmonary edema, anaphylactic reactions; *Musculoskeletal:* Muscle spasm; *Nervous System/Psychiatric:* Restlessness; *Renal:* Renal failure, renal dysfunction, interstitial nephritis (see WARNINGS); *Skin:* Erythema multiforme including Stevens-Johnson syndrome, exfoliative dermatitis including toxic epidermal necrolysis, alopecia; *Special Senses:* Transient blurred vision, xanthopsia.

* Based on patient weight of 50 kg.

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Discussion

Stroke

The number of individuals identified as having new strokes over the period examined was large, as expected, given the prevalence of specific health risk factors (hypertension and diabetes) for stroke in Amerika Samoa. Obtained figures for the annual incidence of stroke in Amerika Samoa were comparable to the annual incidence reported in the United States. During 1989 to 1990, the total population of Amerika Samoan residents age 55 years and above was 3,371[4]. Two percent of those individuals (N=74) were reported to have incurred stroke. Likewise, of the estimated 1989 U.S. population of 248 million, approximately 2 (N=500,000) of those individuals were reported to have incurred stroke[10]. During this same time period, stroke mortality in Amerika Samoa was 1% (N=55) of the population of individuals age 55 and above, whereas stroke mortality in the United States was less than 1% (N=147,470)[10]. The higher stroke mortality in Amerika Samoa may, in part, be related to available primary health-care options for treatment of stroke in Amerika Samoa as compared to that in the United States.

The local population in Amerika Samoa consider stroke to be distinctly different from traditional Samoan illnesses. Stroke is, in fact, referred to as a *palangi* or stranger illness, meaning an illness brought to their population from those of non-Samoan ancestry. This may account for why there is no word in the indigenous Samoan language for stroke.

Stroke is, for the most part, a health problem of the aging. Since the elder Samoan people are more likely to have limited exposure to and proficiency with the English language, it is likely that there is an underreporting of stroke by this population who could have little knowledge of this illness, and perhaps because there is no word to describe stroke when presenting symptomology to their physicians.

An additional point is that although hospital costs average only $5 a day for residents of Amerika Samoa, this amount might not be affordable for many in this country. Thus, many stroke patients might opt to remain at home after a stroke, and might not be accounted for in the LBJ records. For these reasons the actual occurrence of stroke could be higher than is reported here. Further ethnographic investigation into this issue is needed for a more complete understanding of stroke and how stroke is perceived and managed within the context of traditional Amerika Samoan culture, which has its own system of traditional healing or *Fo* medicine[11].

The presence of neurological insult due to stroke is difficult to diagnose in instances where there is no substantial motor involvement. This is particularly true when the diagnosis is being made in a rural community such as Amerika Samoa where there is no neurologist available nor is there medical technology (for example, computerized tomography, magnetic resonance imaging, and angiography) to assist internists in confirming a suspected diagnosis of stroke. In such instances physicians can rely on observations regarding the patient's speech, language and cognitive performance, which could complement clinical medical findings and assist the physician in confirming the presence of neurological impairment and stroke.

Additionally, in Amerika Samoa only a small percent of the physicians have Samoan as their first language. Limited Samoan language proficiency makes it difficult, if not impossible, to identify aberrations in communication which might otherwise facilitate the medical decision regarding diagnosis.

In the present study the majority of stroke patients (86%) were described as having observable motoric involvement. Since so few nonmotor-impaired individuals were identified,

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(Continued from page 237)

patients presenting with *silent strokes* (aberration of communication after stroke in the absence of frank motor involvement) could have been underreported because of the likely difficulty in providing a definite diagnosis in such cases. At present there is no regular staff speech-language pathologist at LBJ who is fluent in Samoan and available to assist with screening neurologically based communication impairment where such problems are suspected. Future inclusion of a speech-language pathologist on the medical team could provide physicians with useful information to facilitate diagnosis where aberrations in communication skills provide an important clue regarding the presence of neurological impairment.

An additional point regarding the number of identified cases of stroke is the fact that identified cases were taken from the inpatient registry only. However, because the LBJ Hospital staff reported that all stroke patients are registered as inpatients, it is unlikely that additional individuals would have been identified had the outpatient roster been inventoried.

TBI

Although proportionately less than cases of stroke, a significant number of both adults and children were identified as having incurred new episodes of TBI severe enough to warrant hospitalization. The obtained annual incidence of TBI in Amerika Samoa was somewhat lower than the incidence of TBI in the U.S. Out of an extrapolated total Amerika Samoan population of 46,150[4] during 1989-90, less than 1% (N=76) incurred TBI. In the same time period, the annual incidence of TBI in the U.S. was 500,000, or 2% of the total U.S population of approximately 248 million[12]. A larger number of individuals (with milder forms of head injury) might have been identified in the annual incidence of TBI in Amerika Samoa had the investigator included outpatients.

Violent assault was a primary causal factor for TBI in Amerika Samoa. This supports previous observations of extreme, violent aggression among the young male population in Amerika Samoa[13-18]. This aggression has been most consistently attributed to stringent discipline in Amerika Samoa, which then generates high levels of anger with no outlet for expression. While social constraints in this culture help to keep in check internal feelings of anger and hostility, display of anger is acceptable when one is presented with a challenge to status or self-esteem, which is considered to be a severe affront. Some have speculated that the effect of social control on self-constraint might be dampened in the young male population, who have a somewhat ambiguous social status. This might account for the high rate of violent assaults in this age group.

Another observation relating to violent assaults and TBI in Amerika Samoa was the repeated report by research informants that current-day brawls are almost always characterized by a conscious effort on the part of the fighters to locate a weapon suitable for executing a blow to the opponent's head. This could suggest a strong influence from traditional Samoan weaponry and warfare on current-day fighting methods (personal communication from the curator of Jean P. Haydon Museum and Director of the American Samoa Archives Office, Amerika Samoa, 1991).

The most frequently reported cause of TBI in the pediatric population was accidental falls. The second most common cause of TBI in this group was, as in the adult population, motor vehicle accidents. The main thoroughfare on Tutuila, Amerika Samoa (where this study was conducted), is bordered by the ocean and circles a good portion of the island. The posted speed limit for this road is 35 mph. Although not posted, the speed for vehicles traveling on roads cutting across the mountainous regions of Tutuila is generally much slower.

In Amerika Samoa many people do not own motor vehicles. Those who do, often purchase pick-up trucks rather than cars, so that the vehicle can be maximally utilized for pooling rides among family members and friends and for other purposes such as carrying building supplies. Although Amerika Samoa has a seatbelt law (American Samoa Government Public Law 20-79), passengers who ride unprotected in the back of pick-up trucks, as long as their bodies do not extend beyond the interior portion of the vehicle (including the floor or the box, bed or frame of the pickup exterior) are not included (Section 22.0704)[19]. This could account for many of the motor vehicle-related traumatic brain injuries in both the adult and pediatric populations.

According to the Chief of Police in Amerika Samoa, the high rate of occurrence of motor vehicle accidents in Amerika Samoa also could be related to the existing motor vehicle safety law, not strongly enforced until 1991. Increased attention to the importance of seatbelt use in preventing accidents is evidenced through the numerous public service announcements recently developed for radio, and 2 large motor-vehicle safety reminder signs placed in the downtown market area as of 1991. These measures will help to reduce the occurrence of head injuries secondary to motor-vehicle accidents in the future.

It is uncertain whether more stringent safety laws for passengers of pick-up trucks would further reduce fatalities and traumatic brain injuries in this country where such a large number of people depend on riding in the rear section of pick-up trucks for their transportation. However, investigation into creative solutions to reduce injuries related to pick-up truck accidents is clearly warranted.

Conclusions

Follow-up investigation over a longer time-span is needed to explore the trend in annual incidence of stroke and TBI in Amerika Samoa. Data presented here indicates there is a sizable number of new, yearly cases of stroke and TBI in Amerika Samoa. Special attention needs to be given to prevention of stroke and especially TBI, which appears to pose a significant health problem in Amerika Samoa. The establishment of local chapters of the American Heart Association and the National Head Injury Foundation may be a useful first step toward community education and the dissemination of information about the prevention of stroke and TBI.

In addition, further research is needed to explore the management of rehabilitation in stroke and TBI individuals in Amerika Samoa. In the continental U.S., it has been reported that more than half of all survivors of stroke and TBI are unable to fully return to their premorbid life-style because of residual impairments in cognition, language, motor speech, feeding/swallowing, ambulation, and emotional adjustment. Rehabilitation has been shown to facilitate re-entry into the community and reintegration by survivors of stroke and TBI. However financial, logistical and cultural variables limit the availability and utilization of rehabilitation services among certain segments of our population; notably the poor, those from the multicultural community and those residing in rural areas.

(Continued on page 240) ➤

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(Continued from page 238)

We, in a follow-up of this study, conducted a field interview survey in Amerika Samoa to obtain information about rehabilitation needs for residents who were identified as having incurred stroke[21] and TBI[22]. Results were that the Physical Therapy Department at LBJ was effective in making its services available to all stroke patients who had difficulty with ambulation or use of the extremities. No physical therapy was provided for the reported cases of TBI. An additional finding was that neither direct nor indirect speech-language pathology services were available for stroke or TBI patients with impairments in communication and feeding/swallowing.

Limitations of funding challenge the expansion of health care for residents of Amerika Samoa, particularly the handicapped. However, greater attention needs to be given to the development of comprehensive rehabilitation services, including speech-language pathology services, for this underserved population. This must be done in order to provide the opportunity for an acceptable quality of life for all residents of Amerika Samoa, including those with stroke and TBI.

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(Continued on page 250) ➤

EDITORIAL
(Continued from page 232)

Ma'i Ulu

In this issue of the *Journal*, we recognize our neighbors to the south—Amerika Samoa.

American Samoans have the rights of citizenship in the USA. Our community includes a great many Samoans and Samoan athletes have put Hawaii on the world map. The coming and going between here and Samoa fill the airplanes.

It seems quite appropriate, therefore, that we have a research article on a public health issue in Amerika Samoa—"Stroke and Traumatic Brain Injury in that southern Pacific group of the islands—known to Samoans as *Ma'i Ulu*."

The author, Gloriajean L Wallace PhD, researched extensively on the subject while she was based in Hawaii at the University during the last decade. She is a speech-language pathologist with imposing credentials and has had a particular interest in the health and well-being of the Samoan people.

J I Frederick Reppun MD

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